CLAIMS

1. A surface acoustic wave device comprising a piezoelectric substrate and an IDT that is formed on said piezoelectric substrate and is made from Al or alloy including Al as a main component, an excited wave being an SH wave, wherein

said piezoelectric substrate is a quartz flat plate where a cut angle θ of a rotation Y cut quartz substrate is set in a range of $-64.0° < \theta < -49.3°$ in a counterclockwise direction from a crystal Z-axis, and a propagation direction of a SAW is set to $(90° \pm 5°)$ to a crystal X-axis, and

when a wavelength of the SAW to be excited is represented as λ, an electrode film thickness H/λ standardized by a wavelength of said IDT is set to satisfy $0.04 < H/\lambda < 0.12$.

2. The surface acoustic wave device according to claim 1, wherein a relationship between the cut angle θ and the electrode film thickness H/λ satisfies

$-1.34082 \times 10^{-4} \times \theta^3 - 2.34969 \times 10^{-2} \times \theta^2 - 1.37506 \times \theta - 26.7895 < H/\lambda < -1.02586 \times 10^{-4} \times \theta^3 - 1.73238 \times 10^{-2} \times \theta^2 - 0.977607 \times \theta - 18.3420$.

3. The surface acoustic wave device according to claim 1, wherein, when an electrode finger width of electrode fingers constituting said IDT/(electrode finger width + space between electrode fingers) is defined as a line metalization ratio mr,

a relationship between the cut angle θ and a product H/λ×mr of the electrode film thickness and the line metalization ratio satisfies

$-8.04489\times10^{-5}\times\theta^3-1.40981\times10^{-2}\times\theta^2-0.825038\times\theta-16.0737<H/\lambda\times mr<-6.15517\times10^{-5}\times\theta^3-1.03943\times10^{-2}\times\theta^2-0.586564\times\theta-11.0052$.

4. A surface acoustic wave device comprising a piezoelectric substrate and an IDT that is formed on said piezoelectric substrate and is made from Al or alloy including Al as a main component, an excited wave being utilized as an SH wave, wherein

said piezoelectric substrate is a quartz flat plate where a cut angle θ of a rotation Y cut quartz substrate is set to satisfy a range of $-61.4°<\theta<-51.1°$ in a counterclockwise direction from a crystal Z-axis, and a propagation direction of a SAW is set to (90°±5°) to a crystal X-axis, and

when a wavelength of the SAW to be excited is represented as λ, an electrode film thickness H/λ standardized by a wavelength of the IDT is set to satisfy $0.05<H/\lambda<0.10$.

5. The surface acoustic wave device according to claim 4, wherein a relationship between the cut angle θ and the electrode film thickness H/λ satisfies

$-1.44605\times10^{-4}\times\theta^3-2.50690\times10^{-2}\times\theta^2-1.45086\times\theta-27.9464<H/\lambda<-9.87591\times10^{-5}\times\theta^3-1.70304\times10^{-2}\times\theta^2-0.981173\times\theta-18.7946$.

6. The surface acoustic wave device according to claim 4, wherein

when an electrode finger width of electrode fingers constituting said IDT/(electrode finger width + space between electrode fingers) is defined as a line metalization ratio mr, a relationship between the cut angle θ and a product $H/\lambda \times mr$ of the electrode film thickness and the line metalization ratio satisfies

$-8.67632\times10^{-5}\times\theta^{3}-1.50414\times10^{-2}\times\theta^{2}-0.870514\times\theta-16.7678<H/\lambda\times mr<-5.92554\times10^{-5}\times\theta^{3}-1.02183\times10^{-2}\times\theta^{2}-0.588704\times\theta-11.2768$.

7. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a one-port surface acoustic wave resonator where at least one IDT is disposed on said piezoelectric substrate.

8. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a two-port surface acoustic wave resonator where at least two IDTs are disposed along a propagation direction of a surface acoustic wave on said piezoelectric substrate.

9. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a lateral coupling type multi-mode filter where a plurality of surface acoustic wave resonators are disposed in proximity to each other in parallel with a propagation direction of a surface acoustic wave on said piezoelectric substrate.

10. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a vertical coupling type multi-mode filter where two-port surface acoustic wave resonators comprising a plurality of IDTs are disposed along a propagation direction of a surface acoustic wave on said piezoelectric substrate.

11. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a ladder type surface acoustic wave filter where a plurality of surface acoustic wave resonators are connected on said piezoelectric substrate in a ladder shape.

12. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a transversal SAW filter where a plurality of IDTs propagating a surface acoustic wave bidirectionally are disposed on said piezoelectric

substrate at predetermined intervals.

13. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a transversal SAW filter where at least one IDT propagating a surface acoustic wave in one direction is disposed on said piezoelectric substrate.

14. The surface acoustic wave device according to any one of claims 1 to 6, wherein

said surface acoustic wave device is a surface acoustic wave sensor.

15. The surface acoustic wave device according to any one of claims 1 to 14, wherein

said surface acoustic wave device has grating reflectors on both sides of an IDT.

16. A module device or an oscillation circuit using the surface acoustic wave device according to any one of claims 1 to 15.